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全球化，外購資源，不完全競爭，與工資不均等性

Globalization, Outsourcing, Imperfect Competition, and Wage Inequality

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主持人：梁文榮

淡江大學產業經濟系

1. Abstract

Wage inequality in the U.S. and its trading partner Mexico has increased since the late 1970s. However, wage inequality in some newly industrializing economies (NIEs) such as Taiwan and South Korea decreases since the late 1980s. We provide a new explanation that a rise in capital flow from the NIE to the less-developed country (LDC), and a corresponding rise in the intermediate good exporting from the vertical multinationals to the subsidiaries in the LDC, have important consequences to account for the decrease in wage inequality of the NIE. We also show that relative wage between skilled and unskilled labor increases in the LDC.

Key Words: Wage Inequality, Capital Flows, Vertical Multinationals, Intermediate Good, the newly industrializing economy, and the less-developed country.

自 1970 年代末期起，美國及其貿易夥伴墨西哥等國的工資不均等性都在持續擴大中，但某些新興工業國如台灣及南韓則相反。本文提供一個新的解

釋：即資本自新興工業國外流至低開發國，以及垂直多國籍企業相對應的增加中間財、原料及設備出口至其在低開發國的子公司，是造成新興工業國之工資不均等性縮小的主因。此外，我們也証明低開發國的工資不均等性會因而擴大。

1. Introduction

Since the late 1970s, the wages of less-skilled U.S. workers have fallen dramatically. The wage inequality between skilled and less-skilled workers is increased, as the wages of skilled workers increase relative to those of less-skilled workers. There are two explanations on the wage inequality of the U.S. One argues that international trade has contributed to the declining wage of the less-skilled workers. The other claims that technological innovation is a more plausible reason. In addition, empirical studies such as Feliciano (1993), and Beyer, Rojas, and Vergara (1999) show that wage inequality in some trading partners of the U.S. such as Mexico and Chile increases too. Feenstra and Hanson (1997) extend the analysis to the low-wage trading partners of the U.S. They give the third explanation that a flow of capital from North to South, and a corresponding rise in outsourcing by Northern multinationals, have contributed

to a worldwide increase in the relative demand for skilled workers. However, little attention has devoted to wage inequality of the newly industrializing economies (NIEs), such as Taiwan and South Korea, which demonstrates totally different pattern from that of the U.S. and Mexico. Chen and Hsu (1999) finds an interesting pattern which shows that wage inequality in Taiwan exhibits a declining trend since the mid-1980s. Chen and Hsu figure out that the relative wage between college graduates or above and mandatory education degree or below decreased by 23.5 percent between 1987 and 1995. Kim and Topel (1995) show that the relative wage in South Korea also has the same trend.

Taiwan has experienced a huge currency appreciation and a rapid increase in production costs since the late 1980s, which cause many domestic firms to invest abroad. Chung (1997) points out that Taiwan's accumulated outward capital investment to China accounts for 24.3 billion from 1986 to 1994, while that to three Southeast-Asian countries is 14.04 billion. Since Taiwan is an NIE, its overseas investment is mainly motivated by low-wage considerations and thus concentrates in labor intensive industries. The multinational enterprises (MNEs) produce the intermediates, equipment, and materials at home, and ship them to the subsidiaries in the less-developed countries (LDCs). This kind of capital outflow is called vertical MNEs. Kao *et al.* (1995) show that 73.4 percent of the equipment and 52.3 percent of the material used by Taiwanese subsidiaries in China come from the vertical MNEs, while 25.8 percent of the subsidiaries uses intermediate goods provided by the vertical MNEs. In addition, Lin (1995) points out that most Taiwanese subsidiaries in Southeast-Asian countries

such as Indonesia, Malaysia, and Thailand also use intermediate goods provided by the vertical MNEs. It so happens because the size of most Taiwanese companies is small or medium and many companies undertake subcontracting production. They have to maintain close connection between the vertical MNEs and the subsidiaries to reduce production costs. We thus provide the fourth explanation that a flow of capital from the NIEs to the LDCs, and a corresponding rise in exporting intermediate goods, materials, and equipment by the vertical MNEs, have caused the decrease in relative wage of the NIEs.

2. The model

Suppose that the economy consists of three parts: the NIE, the LDC, and the rest of the world. The variables of the LDC are indicated with an asterisk (*). The NIE produces two goods: the skilled-labor intensive good (X), and the intermediate good (M) that is unskilled-labor intensive. The production functions are assumed to be linearly homogeneous. They are expressed as:

$$X = X(L_s, K_X), \quad (1)$$

$$M = M(L_u, K_M), \quad (2)$$

where L_i ($i = s, u$) denotes the skilled and unskilled labor employment, K_j ($j = X, M$) represents the capital employment in sector j .

Since all the markets are assumed to be perfectly competitive and there are constant returns to scale, the zero-profit condition in each sector implies that unit cost is equal to the price of the product. By choosing good X to be the numeraire, the price of good X can be normalized to unity. The zero-profit conditions can thus be described as:

$$C^X(w_s, r) = P_X \equiv 1, \quad (3)$$

$$C^M(w_u, r) = P_M, \quad (4)$$

where C^i ($i = X, M$) denotes the unit cost function for good i , w_s (w_u) represents wage rate of skilled (unskilled) labor, r is the rental rate of capital, P_i ($i = X, M$) is the price of good i .

According to equations (1) and (2), we see that skilled labor and capital are used as factors of production for good X , while unskilled labor and capital are for good M . Suppose that there is a flow of capital, namely K_o , from the NIE to the LDC. By the use of Shephard's lemma, the full employment conditions for skilled labor, unskilled labor, and capital can be derivable as:

$$C_1^X(w_s, r)X = L_s, \quad (5)$$

$$C_1^M(w_u, r)M = L_u, \quad (6)$$

$$C_2^X(w_s, r)X + C_2^M(w_u, r)M = K - K_o, \quad (7)$$

where C_i^j ($i = 1, 2, j = X, M$) denotes the partial derivative with respect to the i th variable in the function for sector j , for example $C_1^X = \partial C^X / \partial w_s$, L_i ($i = s, u$) represents the endowment of skilled and unskilled labor, K is the endowment of capital.

Now we turn to develop the subsystem for the LDC. We assume that the LDC produces three goods: the skilled-labor intensive good (X^*), the unskilled-labor intensive good (Y^*), and the subsidiary-produced good (Z^*). Suppose that the subsidiary-produced good employs unskilled labor, intermediate good, and capital. For simplicity, we assume that the intermediate good and capital used to produce good Z^* are provided solely by vertical MNEs. The skilled-labor intensive good uses skilled labor and domestic capital as factors of production, while those used in the unskilled-labor intensive good are unskilled labor and domestic capital. The production functions are all assumed to be linearly

homogeneous, and can be expressed as:

$$X^* = X^*(L_s^*, K_X^*), \quad (8)$$

$$Y^* = Y^*(L_u^{Y^*}, K_Y^*), \quad (9)$$

$$Z^* = Z^*(L_u^{Z^*}, M, K_o), \quad (10)$$

where $L_u^{i^*}$ ($i = Y^*, Z^*$) denotes unskilled labor employed in sector i . We have argued that the pattern of the NIE's overseas investment takes the form of vertical MNE. Hence, the flow of capital from the NIE to the LDC would lead to a corresponding rise in the demand for the intermediate good provided by vertical MNE. To exhibit this characteristic, we assume that the production function of the subsidiary-produced good takes the form of fixed proportion. We thus see that one unit of the intermediate good along with one unit of unskilled labor as well as one unit of capital can be used to produce one unit of good Z^* . We can then derive the following relationship:

$$M = L_u^{Z^*} = K_o = Z^*. \quad (11)$$

By assuming that all markets are perfectly competitive, the long-run equilibrium conditions for commodity markets are:

$$C^{X^*}(w_s^*, r^*) = P_X^* \equiv 1, \quad (12)$$

$$C^{Y^*}(w_u^*, r^*) = P_Y^*, \quad (13)$$

$$C^{Z^*}(w_u^*, P_M, r) = P_Z^*, \quad (14)$$

where C^i ($i = X^*, Y^*, Z^*$) denotes the unit cost function for good i , P_i^* ($i = X^*, Y^*, Z^*$) represents the price of good i . We assume that relative to the rest of the world, the two countries are small. Under the assumption of small open economy, The price of good Y^* is exogenously given. However, since the intermediate good is provided solely from the vertical MNEs, its price is endogenously determined.

By the use of Shephard's lemma, the full employment conditions for skilled labor, unskilled labor, and capital in the LDC are derivable as:

$$C_1^{X^*}(w_s^*, r^*)X^* = L_s^*, \quad (15)$$

$$C_1^{Y^*}(w_u^*, r^*)Y^* + C_1^{Z^*}(w_u^*, P_M, r)Z^* = L_u^*, \quad (16)$$

$$C_2^{X^*}(w_s^*, r^*)X^* + C_2^{Y^*}(w_u^*, r^*)Y^* = K^*. \quad (17)$$

Note that the foregoing system consists of thirteen equations. They are (3)-(7), and (11)-(17). It contains thirteen endogenous variables: w_s^* , w_u^* , r^* , P_M , X^* , M , w_s^* , w_u^* , r^* , P_Z^* , X^* , Y^* , and Z^* , and a policy variable K_o .

3. Concluding remarks and discussion

By manipulating the aforementioned model, we see that a rise in the flow of capital increases the output of the intermediate good. This will create an excess demand for unskilled labor, since the intermediate good is unskilled-labor intensive. The wage rate of unskilled labor will thus rise. On the other hand, since the output of good X falls and good X is skilled-labor intensive, this will create an excess supply of skilled labor and then lowers the wage rate of skilled labor. Hence, the wage inequality of the NIE decreases. We can thus establish:

Proposition 1. Suppose that the NIE's vertical MNEs export the intermediate good to the subsidiaries in the LDC, and that the production function of the subsidiary-produced good is fixed proportion. A rise in the flow of capital decreases wage inequality of the NIE.

By calculating the model, we see that owing to the fixed proportion production function of good Z^* , a rise of capital flow increases the employment of unskilled labor in producing Z^* . The demand for unskilled labor is thus increased, and then raises the wage rate of unskilled labor. Consequently, the wage

rate of both the skilled and unskilled labor rises. However, from the long-run equilibrium condition of goods X^* and Y^* , we see that the relative wage between skilled and unskilled labor increases if good X^* is capital intensive. It so happens because rental rate of capital falls, and tends to increase profits of good X^* more if good X^* is capital intensive. Hence, the wage rate of skilled labor has to increase more to restore the zero-profit condition. We can thus derive the following proposition:

Proposition 2. Suppose that the NIE's vertical MNEs export the intermediate good to the subsidiaries in the LDC, and that the production function of the subsidiary-produced good is fixed proportion. A rise in the flow of capital increases wage inequality of the LDC if good X^ is capital intensive.*

We can then derive the following conclusion. A rise in the flow of capital from the NIE to the LDC, and a corresponding rise in exporting intermediate good by the NIE's vertical MNEs, have important consequences for the wage inequality of the two countries. They decrease relative wage between skilled and unskilled labor of the NIE, while increase that of the LDC. This result stands in sharp contrast to the previous works, and provides a new explanation to account for the wage inequality of the NIE and LDC.

4. Self-evaluation

This paper satisfies most of the contents in the proposal. We drop the imperfect competition as a factor of wage inequality of the NIE, while introduce a flow of capital from the NIE to the LDC and a corresponding rise in the intermediate good exported by the vertical

MNEs as the crucial factors. Introducing these two factors, we succeed in explaining why wage inequality in the NIE has increased since the mid-1980s. In addition, we show that wage inequality in the LDC will increase.

This paper fulfills the whole requirements outlined in the proposal. We provide a new explanation on the wage inequality of the NIE, which is not found in the previous studies. There must be a good chance to publish this paper in academic journals.

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